Development of Integrated Strategy for Managing Construction Sector in Iraq

Project Management Maturity Models

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ABSTRACT

A lot of construction projects fail to complete their processes according plans, leading to financial and technical problems. The paper tries to study the extent to which the application of best management practices will have a quantitative measurable effect on project success. The researcher developed a model to assess project management maturity for a sample study of the Iraqi ministry of construction and housing and public municipalities, then applied regression analysis to find the correlation of the maturity level of the cost, time management and the average project management processes maturity level and also deviation coefficient during the year (2007-2014).

Keywords: Project management methodology, Project management maturity, Regression analysis

Project Management Maturity Models

INTRODUCTION

A subset of strategic planning for project management, project management maturity models provide a means of identifying the necessary steps to be taken, the tasks it is necessary to accomplish, and the sequence of events needed to realize meaningful and measurable results. Basically, the purpose of the maturity model is to provide a framework for improving an organization's business result by assessing the organization's project management strengths and weaknesses, enabling comparisons with similar organizations, and a measure of the correlation between an organization's project management level and actual project performance **(1)**.

Constructions differ in maturity project management levels, some of which have a high level of maturity and stability, including what had begun maturity trip just level. Some Constructions do not realize what is project management and others think it has reached the desired level of maturity.

In this research, the maturity level of the Iraqi Ministry of Construction and Housing and Public municipalities could be evaluated on the base of the Pmbok 5th processes.

Outline of the Model

The Iraqi Ministry of Municipalities and Public Works previously, (Ministry of Construction and Housing and Public municipalities currently); is the key in making national policy on all municipal services, except electricity and telecommunications. It is the entity responsible for the

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provision of potable water and sewage treatment and solid waste in addition to the municipal road networks and the management of public property **(2)**.

Development of the Model

The analysis of the relationship between investment and economic growth is one of the most important planning work methods by which identify the views of the economy and diagnosis of key sectors driving growth so that the planner redirect investments, according to the elasticities achieved growth which serves as the weights relative weighting sector to another sector in order to achieve the goal sought by the planned in the development of future strategies.

1) Figure (1) Shows the number of the investment plan of the Iraqi Ministry of Construction and Housing and public municipalities / General Directorate of Planning and Follow-up, for the period from 2007 to 2014 and observe that the number of projects was low and then increased during the (2012,2013) and then return to declining in 2014.

2) Figure (2) Shows the planned and Actual costs of the projects during the years 2007 to 2014. It is noted that the actual exchange rates have exceeded what is planned for all projects except for projects in 2014 and the fact that it is still under Construction, meaning that the actual cost ratios do not fit with its planned amounts.

Figure (1): Project number of Iraqi MCHPM/ general Directorate for planning and follow-up for the period (2007-2014)

Figure (2): The planned cost and actual cost (in billion dinar) of Iraqi MCHPM Projects for the period (2007-2014)

The success of the project depends on matching the planned time and the cost of the project and to assess these criteria, where the following equations calculate **(3)**:

Cost Deviation = (Actual Cost / Planned cost) * 100% …….. (1)

For example; in 2007 Cost deviation= (1186979748000/295342833000)

= 4.02

Time Deviation (Actual time / Planned time) * 100% …… (2)

For example; in 2007 Time deviation= (955/612)

= 1.56

3. The level of maturity = (Number of completed projects / Total number of projects) * C .. . . (3)

C = distribution of the project management Knowledge area of 100, as each Knowledge area degree 10 to be a grand total of 100 (Researcher).

It has found the value of the cost and the time deviation from the data shown in the Table (1), and observed that whenever the value of a few deviation coefficient whenever the project is better performance

Table (1): Planned Cost and Actual Cost, Cost and Time deviation Coefficient of the Iraqi MCHPM Projects for the period (2007-2014)

Project in years	Planned cost IQ/million	Actual cost IQ/million	Cost deviation Coefficient *100%	Planned Time/day	Actual Time/day	Time deviation Coefficient * 100%
2007	295342833000	1186979748000	4.02	612	955	1.56
2008	141898525000	2413056707000	17.01	693	1415	2.04
2009	543741000000	1380812841000	2.54	650	1370	2.1
2010	1194494158000	2638465365000	2.21	567	715	1.26
2011	2618071289000	3142308861200	1.2	729	1154	1.58
2012	3173569333000	4340252583000	1.37	866	1005	1.16
2013	1816990500000	1899743351000	1.22	628	618	0.98
2014	2152621000000	463224976500	0.22	456	950	2.08
Average	**1492091079750**	**2183105554087.5**	**3.72375**	**650**	**1022**	**1.595**

For example in 2007, it calculates the Time deviation coefficient, as shown in the table below;

Table (2): Example of time deviation coefficient in 2007

Number of projects	Planned Time Day	Actual Time Day	Calculation (Actual time/ Planned Time)	Time deviation Coefficient in 2007
1	600	1296	1296/600	2.16
2	600	714	714/600	1.19
3	720	799	799/720	1.1
4	540	448	448/540	0.82
5	730	1213	1213/730	1.66
6	485	1203	1203/485	2.48
Average				**1.56**

To calculate the maturity level of cost and maturity level of time, this showed in Table (3), for clarification, in 2007:

Maturity level of cost in 2007= (2/6)*10=3.3

Where, 2; Represent the numbers of projects completed within cost in 2007.

6 ; Project number in 2007.

10 ; The degree of cost, according to the researcher distribution of project management knowledge area.

Maturity level of time in 2007= (3/6)*10=5

Where, 3; Represent the numbers of projects completed within time in 2007

6; Project number in 2007

10; The degree of time according to the researcher distribution of project management knowledge area.

Table (3): Maturity level of Cost and Time through year (2007-2014)

Years	Cost Management Maturity Level *100%		Time Management Maturity Level *100%	
	Result	Calculation	Result	Calculation
2007	3.3	(2/6)*10	5	(3/6)*10
2008	3.8	(8/21)*10	3.8	(8/21)*10
2009	3.3	(3/9)*10	4.4	(4/9)*10
2010	3.6	(5/14)*10	2.8	(4/14)*10
2011	2.9	(5/17)*10	2.3	(4/17)*10
2012	2.9	(15/51)*10	2.5	(13/51)*10
2013	2.8	(16/56)*10	2.5	(14/56)*10
2014	3.9	(7/18)*10	2.8	(5/18)*10
Average	**3.3125**	**3.3125**	**3.2625**	**3.2625**

To calculate the maturity level of (Integration Management, Scope management, Quality management, human resource management, Communication management, Risk Management, Procurement management and stakeholder management), and because of the absence of quantitative criteria has been used qualitative criteria to see whether the processes applied or not applied and after collecting answers from Ministry of Construction and Housing and Public municipalities engineers, grades that have been reached illustrated in Table (4).

Table (4): Maturity Level of project management knowledge area of Iraqi MCHPM

Years	Maturity Level										
	Integration	Scope	Quality	Human resources	Communication	Risk	Procurement	Stakeholder	Cost	Time	**Sum**
2007	0	0	5	10	5	0	10	10	3.3	5	**48.3**
2008	0	0	5	10	5	0	10	10	3.8	3.8	**47.6**
2009	0	0	5	10	5	0	10	10	3.3	4.4	**47.7**
2010	0	0	10	10	5	0	10	10	3.6	2.8	**51.4**
2011	0	0	10	10	5	0	10	10	2.9	2.3	**50.2**
2012	0	0	10	10	5	0	10	10	2.9	2.5	**50.4**
2013	0	0	10	10	5	0	10	10	2.8	2.5	**50.3**
2014	0	0	10	10	5	0	10	10	3.9	2.8	**51.7**

Where in Table (4) above, [0] represents that the process is not applied, [5] represents the process is partly applied, while [10] means that the process is applied.

When the average Maturity Level of the ten project management knowledge area for the period 2007-2014 is collected, it is found that the rate applied in the Iraqi Ministry of Construction and Housing and public municipalities totaled 52.352%, as in the Table (5). The researcher believes that this ratio is low and unacceptable due to the negligence of project management and higher management, thereby, this proves that it is necessary to encourage workers in the project management field to take advantage of the new application Android (SIPMM) which applied in this research, which will be a great support and measures the level of development of their methodology for managing projects.

Table (5): Average maturity level of project management knowledge area % and its distribution of 100

Project Management Process	C	Average Maturation Level %
Integration	10	**0**
Scope	10	**0**
Time	10	**3.3**
Cost	10	**5.9**
Quality	10	**8.125**
Human Resources	10	**10**
Communication	10	**5**
Risk	10	**0**
Procurement	10	**10**
Stakeholder	10	**10**
Total	**100%**	52.325

Evaluation of the Model

To Identify the correlation between maturity level of cost for a period of eight years (2007-2014), and the maturity Level of time as well as the overall average maturity level, through using the consequences of the decline analysis in the Excel program as the Figure (3), (4) and Figure (5) clarifies the correlation and equations that represent the relationship with the correlation.

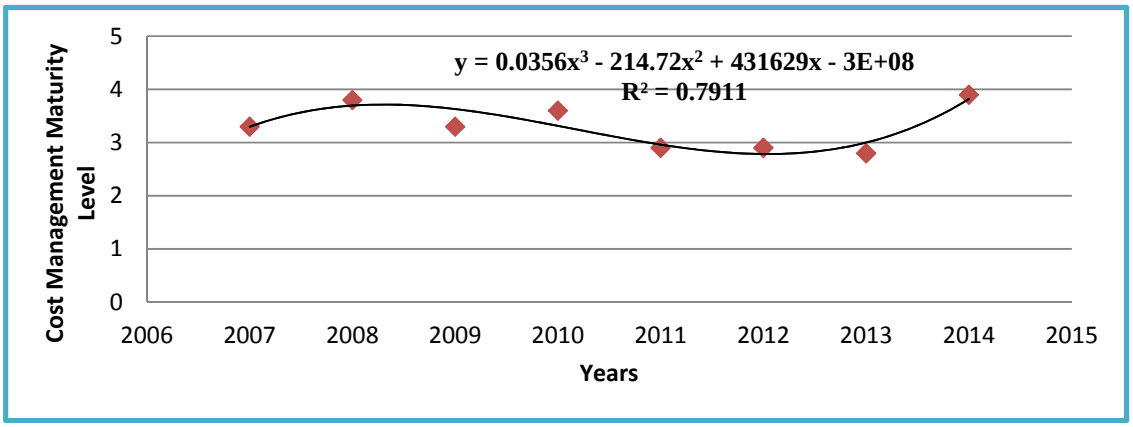

Figure (3): Correlation between Maturity Level of the cost management through eight years (Model-1)

For Model- 1, The following statistical tests were conducted on "R" (the coefficient of correlation) value for cost maturity level, where R2=0.7911, N=8**:**

1) Probable Error (P.E.) in "R" value

$$P.E. = 0.6745\left[\frac{\left(1-R^2\right)}{\sqrt{N}}\right] \quad \ldots (4)$$

P.E. = 0.04981 therefore**, R=0.8894 ± 0.04981**

According to (**Alzwainy, 2008 Citied by *Gupta, B. N.* (1973)) (4)**; the probable error is regarded as a measure of significance of Karl Person's coefficient of correlation (R), and if the probable error is small (compared with R), correlation directly exists where R> 0.5

Hence, the correlation of the studied cost equation is existing.

2)Standard Error (S.E.) in "R" value

$$S.E. = \left(\frac{1+R^2}{\sqrt{N}}\right) \quad \ldots (5)$$

S.E. = 0.63324

The correlation is accepted for R=0.90166, and 8 observations.

3)Test of significance

(Alzwainy, 2008 Cited by *Gupta, B. N.* (1973)) (4)*;* indicates that the correlation may be accepted when R>0.22 (for 8 observations)

Again, the correlation is accepted for R=0.8894, and 8 observations.

4)A simple method of testing whether "R" differs significantly from "zero"

Taking null hypothesis that there is no correlation between the two variables, provided "N" is large:

$$\frac{3}{\sqrt{N}} \quad \ldots\ldots (6)$$

IF the value arrived at by this test is greater than the observed or computed value of correlation coefficient ($R<\frac{3}{\sqrt{N}}$) correlation is not significant. **(Alzwainy, 2008 Cited by *Gupta, B. N.* (1973)) (4);**

$$\frac{3}{\sqrt{N}}=\frac{3}{\sqrt{8}}=1.06 > 0.8894$$

Hence, coefficient of correlation is not significant.

5)"t" test

There is another test of significance of coefficient of correlation, in which the value of "t" is, computed by the following formula:

$$t=\frac{R*\sqrt{N-2}}{\sqrt{1-R^2}} \quad \ldots.. (7)$$

IF the computed value of "t" is greater than the table value, the correlation is taken as significant.

$t=\frac{R*\sqrt{N-2}}{\sqrt{1-R^2}}=t=\frac{0.8894*\sqrt{8-2}}{\sqrt{1-0.7911}}=4.766$ > tabulated "t". This means the correlation coefficient is highly significant.

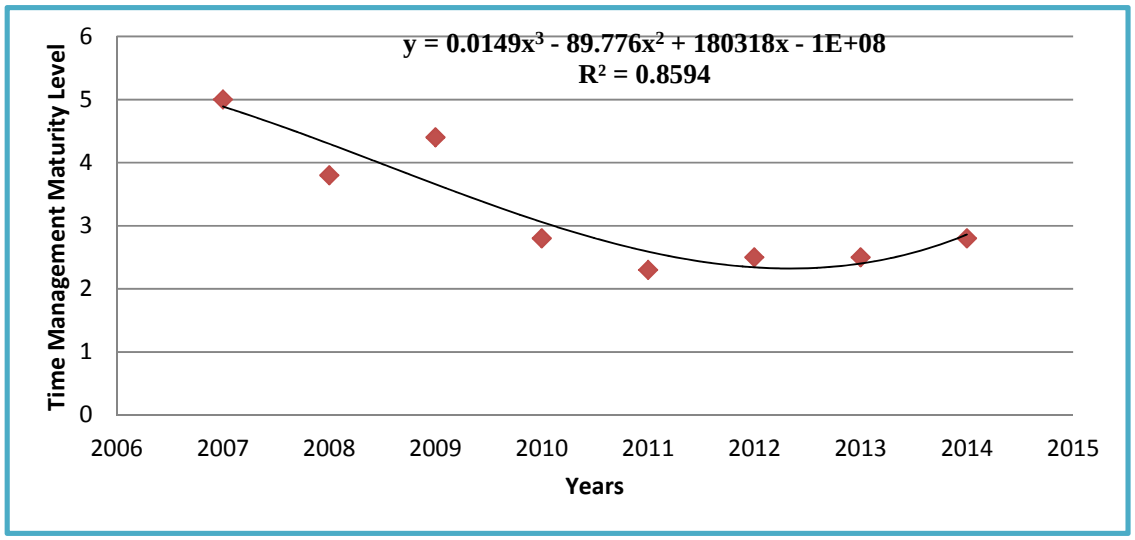

Figure (4): Correlation between Maturity Level of the Time management through eight years (Model-2)

For model- 2, The following statistical tests were conducted on "R" (the coefficient of correlation) value for cost maturity level, where R2=0.8594, N=8**:**

1)Probable Error (P.E.) in "R" value

$$P.E. = 0.6745\left[\frac{\left(1-R^2\right)}{\sqrt{N}}\right] \quad \ldots (8)$$

P.E. = 0.03352 therefore**, R=0.92703 ± 0.03352**

According to **(Alzwainy, 2008 Cited by *Gupta, B. N.* (1973))(4)**; the probable error is regarded as a measure of significance of Karl Person's

coefficient of correlation (R), and if the probable error is small (compared with R), correlation directly exists where R> 0.5

Hence, the correlation of the studied cost equation is existing.

2)Standard Error (S.E.) in "R" value

$$S.E. = \left(\frac{1+R^2}{\sqrt{N}}\right) \quad \ldots\ldots (9)$$

S.E. = 0.657397

The correlation is accepted for R=0.92703, and 8 observations.

3)Test of significance

(Alzwainy, 2008 Cited by *Gupta, B. N.* (1973)) (4)*;* indicates that the correlation may be accepted when R>0.22 (for 8 observations)

Again, the correlation is accepted for R=0.92466, and 8 observations.

4)A simple method of testing whether "R" differs significantly from "zero"

Taking null hypothesis that there is no correlation between the two variables, provided "N" is large:

$$\frac{3}{\sqrt{N}} \quad \ldots\ldots (10)$$

IF the value arrived at by this test is greater than the observed or computed value of correlation coefficient ($R<\frac{3}{\sqrt{N}}$) correlation is not significant. **(Alzwainy, 2008 Cited by *Gupta, B. N.* (1973)) (4)*;***

$$\frac{3}{\sqrt{N}} = \frac{3}{\sqrt{8}} = 1.06 > 0.92703$$

Hence, coefficient of correlation is not significant.

1) "t" test

There is another test of significance of coefficient of correlation, in which the value of "t" is, computed by the following formula:

$$t = \frac{R * \sqrt{N-2}}{\sqrt{1-R^2}} \quad \ldots.. (11)$$

IF the computed value of "t" is greater than the table value, the correlation is taken as significant.

$t = \frac{R*\sqrt{N-2}}{\sqrt{1-R^2}} = t = \frac{0.92466*\sqrt{8-2}}{\sqrt{1-0.8594}}$ =6.0558 > tabulated "t". This means the correlation coefficient is highly significant.

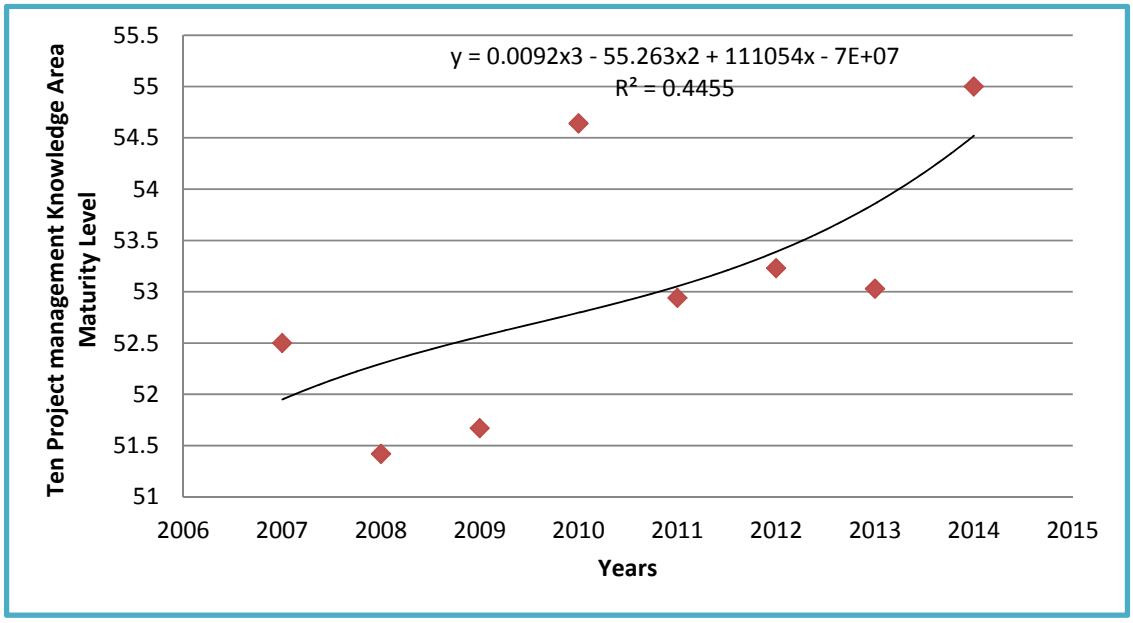

Figure (5): Correlation between the Maturity Level of Ten project management knowledge area during years (2007-2014) (Model-3)

For Model-3, The following statistical tests were conducted on "R" (the coefficient of correlation) value for cost maturity level, where R2=0.4455, N=8**:**

1)Probable Error (P.E.) in "R" value

$$P.E. = 0.6745\left[\frac{\left(1-R^2\right)}{\sqrt{N}}\right] \quad \ldots\ldots (12)$$

P.E. = 0.13223 therefore**, R=0.66745 ± 0.13223**

According to **(Alzwainy, 2008 Cited by *Gupta, B. N.* (1973))(4)***;*** the probable error is regarded as a measure of significance of Karl Person's coefficient of correlation (R), and if the probable error is small (compared with R), correlation directly exists where R> 0.5

Hence, the correlation of the studied cost equation is existing.

2)Standard Error (S.E.) in "R" value

$$S.E. = \left(\frac{1+R^2}{\sqrt{N}}\right) \quad \ldots\ldots (13)$$

S.E. = 0.511061

The correlation is accepted for R=0.66745, and 8 observations.

3)Test of significance

(Alzwainy, 2008 Cited by *Gupta, B. N.* (1973)) (4)*;* indicates that the correlation may be accepted when R>0.22 (for 8 observations)

Again, the correlation is accepted for R=0.66745, and 8 observations.

4)A simple method of testing whether "R" differs significantly from "zero"

Taking null hypothesis that there is no correlation between the two variables, provided "N" is large:

$$\frac{3}{\sqrt{N}} \quad \ldots (14)$$

IF the value arrived at by this test is greater than the observed or computed value of correlation coefficient ($R<\frac{3}{\sqrt{N}}$) correlation is not significant. **(Alzwainy, 2008 Cited by *Gupta, B. N.* (1973)) (4)*;***

$$\frac{3}{\sqrt{N}}=\frac{3}{\sqrt{8}}=1.06 > 0.66745$$

Hence, coefficient of correlation is not significant.

5)"t" test

There is another test of significance of coefficient of correlation, in which the value of "t" is, computed by the following formula:

$$t=\frac{R*\sqrt{N-2}}{\sqrt{1-R^2}} \quad \ldots.. (15)$$

IF the computed value of "t" is greater than the table value, the correlation is taken as significant.

$$t=\frac{R*\sqrt{N-2}}{\sqrt{1-R^2}}=t=\frac{0.66745*\sqrt{8-2}}{\sqrt{1-0.4455}}=2.19551291$$ > tabulated "t". This means the correlation coefficient is highly significant.

CONCLUSIONS

Through the research work, there are conclusions that can be summarized by the following points:

1. The rates of the actual costs have exceeded the planned for all projects except for projects in 2014 and the fact that it is still under Construction, meaning that the actual cost ratios do not fit with its planned amounts.
2. The average Maturity Level of the ten project management knowledge area for the period 2007-2014, in the Iraqi Ministry of Construction and Housing and public municipalities totaled 53.045%, and this ratio is low and unacceptable due to the negligence of project management and Higher management.
3. The Correlation between Maturity Level of the cost management through eight years is 79%
4. The Correlation between Maturity Level of the time management through eight years is 85%

5. The Correlation between Maturity Level of the overall project management processes through eight years is 44%.

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